Canadian Perspectives on Wireless Internet for Small Urban Businesses

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Abstract

The overall objective of this workshop is to discuss the use of ICTs to better support and assist in the development of business clusters in developing nations. To that end, this paper will highlight some experiences relating to Canadian small businesses. More specifically, it will focus on exploring conventional wireless and mesh-networking technology for small retail businesses in urban Toronto neighbourhoods. It will rely on previous work done on wireless networking in urban neighbourhoods as well as the experiences of a local wireless ISP to help explore this topic. In addition to presenting a "lessons learned" perspective, it will also serve to highlight some issues of relevance to emerging markets for wireless technology, such as the challenges and opportunities arising from cost and technological limitations.

1. Urban Toronto Internet and Wireless Nomad Co-operative, Incorporated.

While Toronto generally has a successful business and economic sector, small enterprises often encounter many challenges while trying to develop. For example, in 2006, Toronto was ranked 47th out of 144 of the most expensive cities in the world, and the most expensive Canadian city out of those surveyed (Beauchesne, 2006, para.3). Furthermore, while the city boasts major banks, insurance companies, the Toronto Stock Exchange, and the desire to build high tech and health care sectors, the reality is that many neighbourhoods in the city also suffer from poverty and the lack of social services. The Mayor of Toronto, in a speech to the chambers of commerce for several municipalities of Toronto, noted these deficiencies and the impact it has on the residents of these neighbourhoods (Miller, 2007). While the city has established some support for small businesses, such as lowering taxes and providing start-up services like information websites for new small business owners, the fact is that many of developing enterprises still face significant hurdles. One of the challenges that small businesses can face is access to the Internet. Toronto is fortunate to be well-served by a variety of broadband Internet services including Digital Subscriber Lines (DSL) and cable Internet. While there are a number of different providers available for individuals and businesses to choose from, Toronto is dominated by the incumbent telephone company, Bell Canada, and the incumbent TV cable company, Rogers Communications Inc. The difficulty this poses is that even the most basic business Internet plan from either of these providers can cost $60 CDN/per month or more[1], which may be prohibitively expensive to small

[1] Up to 6 mpbs download service is $59.95/month with Rogers, and $74.95/month with Bell, as of June 3, 2007

businesses. Such businesses may benefit from Internet access and a web presence, but perhaps not at the costs demanded by the dominant providers.

Smaller Internet providers in the city are aware of this problem and alternatives to the major incumbent players do exist. Many of these alternative providers exist to help alleviate the same problem for residential access too. One such provider is Wireless Nomad Co-operative Inc., a co-operatively run, Toronto-based ISP specializing in wireless Internet access. Started in early 2005, Wireless Nomad (WN) began as an initiative to return many of the Internet capabilities to users that ISPs had discouraged or prevented, such as running personal servers, full port access, and capping traffic. A major initiative for WN also included wireless signal sharing, which they built directly into their network technology. WN focussed strongly on building a local Internet service solution for both residential users and small businesses. As a small business itself however, WN would face a number of significant challenges in its subsequent growth and development. The Canadian Research Alliance for Community Innovation and Networking (CRACIN) and more recently the Canadian Wireless Infrastructure Research Project (CWIRP) has been working with and studying WN for the last two years.

2. Wireless Nomad's Sharing Technology and Practices

WN, partly due to financial constraints but mostly due to a philosophical disposition, exclusively uses open source software in their wireless technology. They use commercially available Linksys-brand 802.11g wireless routers as their main networking device. These routers operate in the 2.4 GHz ISM band. The routers are reprogrammed using OpenWRT[2], which is Linux-based software designed for embedded devices (specific function-performing computers). The software installation allows WN to provide customized functions and operations into the router package. In addition to standard wireless router functions such as providing both wired and wireless network connectivity, the reprogrammed router also allows for user authentication and participation in the shared WN network. WN signal sharing involves broadcasting an open wireless signal that can be detected by anybody with a wireless device that is in range of the broadcasting routers. Once a user has created a free WN account, they are able to access this signal to connect to the Internet. However, access is limited to 128 kbps and common email ports are blocked (web-based email would still be available). The free accounts are limited to ensure fairness for the node owner, who is a paying WN subscriber/co-operative member. WN uses DSL connections wholesaled by a third-party from Bell Canada. The current subscription rate is $36.95 CDN/month for an up to 3 mbps connection. This is slightly less expensive than the other popular ISPs. WN's business model also sets up each subscriber as a voting member of the co-operative, who end up being involved in some of the administration of the organization (e.g. decisions about WN's practices and overall direction).

WN has also experimented with mesh-networking technology. As O'Brien (2003) describes, mesh networking "is a technique for creating self-organizing clusters of computers that make their own connections between one another, spreading their

[2] See http://openwrt.org

coverage one node at a time across any terrain, with no central planning authority" (pg.1). Wireless nodes in a mesh network act as "both a service provider and a service consumer" (Xue & Ganz, 2002, p.180). That is, each node has the ability to help rout data, as opposed to relying on centrally controlled access points alone. A very powerful aspect of mesh networking is the ability to "self-heal" in that the network routs around downed or unreachable nodes, to try and make sure that data is properly transmitted to each operational node. This kind of redundancy means that when individual nodes go down, the rest of the network can continue to function. WN deployed a small testing network in a residential neighbourhood that had seven operational nodes using three DSL connections as bandwidth supply. WN uses an implementation of the Optimized Link State Routing protocol with the OpenWRT software.

3. Wireless Nomad's Experiences with Small Businesses

When WN began, they originally had two main business streams: wireless residential service and "Hot Wireless", their business service brand. Within a matter of months, their Hot Wireless business service became too difficult to maintain. While the primary reason for this was the overwhelming amount of work that was going into supporting the residential business, they also had difficulty signing up business subscribers. The original pitch was for hospitality-based small businesses, such as cafes and restaurants, to subscribe to the WN DSL service for a fee and then offer it to patrons as an additional service. Hot Wireless was a "service within a service" in that the businesses might not have directly benefited from having Internet access for themselves, but rather used wireless access primarily as an attractant for potential customers. Unfortunately, this aspect of the WN business did not ultimately succeed.

WN experienced a number of challenges by virtue of being an entrepreneur-based, small business itself. For example, WN was funded and operated entirely by the two co-founders who put in all the time and effort to start the co-operative. All of the technical and administrative responsibilities were also handled by the co-founders. WN also faced a number of difficulties associated with buying DSL circuits and wholesale bandwidth from often uncooperative or expensive suppliers[3]. Finally, the co-founders noted that while they had been assisted by a small business development training program, in retrospect, the trainers had known nothing about the Internet service business or how to effectively incorporate the Internet into their operations.

In subsequent months, with WN's business operating a bit more stably through small, but steady, residential customer subscriptions, the co-founders considered alternative means for generating revenue. One of the approaches that they focused on, particularly given some limited success with their mesh-networking experiment, was deploying low-cost wireless to "budget" retail locations. These primarily consisted of the small one or two-storey retail locations that frequently line the major city streets in Toronto's urban core. Through the use of their mesh technology, they hypothesized that

[3] DSL and Cable line owners (Bell and Rogers in Toronto) are required by law to resell their lines to third-party resellers. However, based on WN's experience, they do this grudgingly or not at all. For example, Rogers never responded to repeat requests to lease cable lines.

they could start with a single subscriber and one DSL take-out point connected to a mesh-enabled router. Nearby businesses could then detect this signal and WN would split the cost among the different subscribers. WN anticipated a fee in the range of $10-20/month depending on the number of subscribers. They felt that this represented the best value option for small businesses in that their share of the network traffic would likely be less than 1 mbps but this was probably sufficient for both email access and web surfing. Furthermore, they felt that at a price range of potentially only $10/month, this would be a more cost effective proposition for businesses interested in some Internet access but not at the multi-megabit and $50+/month business connections offered by the incumbents. The network would theoretically be extensible with the use of the mesh technology. More nodes and more DSL connections could be added as necessary to increase both the robustness and redundancy of the network. Unfortunately, while WN highlighted a desirable and evidently untapped market, they were hindered from pursuing this project by a number of factors. One factor was the unproven nature of the mesh technology. While they had had some success with a residential deployment, this was based around one of the founder's own home and with friendly and accommodating neighbours nearby. Furthermore, they were experiencing overheating problems with the mesh routers mounted inside all-weather plastic housings. These concerns lead to reluctance to charge fees to small business without more thoroughly tested equipment. Another factor was the lack of time and manpower available to devote an estimated six months to getting this project off the ground. Already, the co-founders and a handful of volunteers were swamped maintaining the existing residential network. Thus, ultimately, WN was not able to achieve this urban small business project beyond these early planning stages.

4. Potential Areas of Opportunities and Challenges

While WN's original attempt at small business Internet subscriptions and the subsequent mesh-networking project did not succeed, their efforts suggest both a number of opportunities and challenges. First and foremost, their recognition of these smaller businesses with fewer resources than their larger counterparts highlights the need for lower priced Internet access. In particular, it addresses a potential market for organizations that might not require, or would be willing to pay less for, less bandwidth-intensive connections. At the same time, it also recognizes a need for access that is greater than dial-up speed (56 kbps), which is often unacceptably slow, even for a small business. For a small independent business where finances might be very tight, $50-60/month may be an unreasonable cost when factored in with all the other expenses that a small business might be responsible for. A lower-cost Internet service helps to provide more options.

The choice of wireless in particular is also noteworthy because for many of these budget retail operations, wireless is ideal for the compact geographical locations they inhabit. While the subject of wireless range is somewhat of a grey-area due to the variety of different environmental and equipment factors involved, typically, 802.11g devices are able to cover dozens of meters indoors from a broadcast point (Zyren, Enders & Edmonson, 2003). In an indoor environment this is usually because common building materials such as wood, plaster, and glass are considered "low" barriers to radio

frequency signals (Dubendorf, 2003, pg.110). In many of these low, compact building strips, they may only be separated by a few layers of drywall. As a result, several businesses might be well served by strategically placed wireless routers.

In theory, a setup such as that proposed by WN, since it uses commercially available and somewhat older technology, could be relatively ease to use and maintain. For example, 802.11g is a standard wireless technology that is present in many of today's modern laptops. Even USB-based wireless adapters for desktop computers are readily available. While it would take a bit of effort to initially setup the wireless router and configure each computer to the particular network settings of that router (e.g. through the Windows operating system), theoretically, the computer could generally be set to automatically connect to the wireless signal in all subsequent networking sessions. The fact that such a wireless setup would make use of existing hardware and software would be a bonus in that additional costs and training would likely not be that demanding.

Of course, there are some distinct challenges posed by such a network too. For one, mesh-networking is somewhat limited in its node configuration. Mesh nodes benefit from close proximity to one another and being able to "see" multiple nodes from any one node. In a less desirable configuration, the nodes are linked together linearly. This poses a problem if any of the nodes in the middle of the line go down, which might strand the nodes on the ends. This is particularly problematic if the nodes in the middle are the ones connected to the Internet. Nodes on the ends would also lose their connection. While wireless signals can penetrate most indoor materials fairly well, on the other hand, bricks, concrete, and metal (such as reinforced walls) may pose greater signal barriers. Thus, signals might work well in a small complex or along a street fairly well, but less so when there are numerous distinct buildings that are separated from each other. As suggested by WN, the price would be commensurate with the expected reliability and speed of the connection. However, in cases where interference or signal blocking might be high, or even if one store decides to use the microwave in the backroom, wireless signals might be interrupted or degraded significantly. While presumably subscribers to the service might be aware of this given the low price offered, it is relevant to their use of the service, particularly if having Internet access becomes more important or useful to their business.

5. Points of Comparison and Future Work

It is important to distinguish some key features of this exposition on one Canadian ISP's experience versus developing environments. Notably, in both of WN's examples, there was a preponderance of "hotspot"-type models where there is a known area of wireless Internet access. In the Hot Wireless model, this would be in cafes and restaurants. In the budget retail model, there would be one or more broadcasting points to connect to, but likely no hard-wired Ethernet access port. These models help to reduce costs by utilizing the broadcast nature of wireless, but on the other hand, as has been noted, have a tendency to reduce the reliability and potential availability of Internet access. Clearly this might be less useful for small businesses that rely on the Internet for more than just low-priority or superficial aspects of their business. For example, in a small business that relies primarily on online transactions or web-based marketing.

Furthermore, this kind of Internet access may be significantly less practical in larger workplaces, for example, warehouses or manufacturing facilities. Indeed, the high presence of metal equipment or other RF devices may make pure wireless deployments unworkable. It is important to note how this paper describes a particular conception of small businesses in a way that might vary dramatically from other conceptions of small businesses, especially in developing nations.

Another distinction is that Canadian cities, particularly major metropolitan areas like Toronto, generally have very high telecommunications densities. Wireless is a useful alternative to traditional wired approaches, but ultimately still relies on the availability of backbone Internet infrastructure. In developing nations where telecom density might be quite low and access broadband connections are difficult to arrange, wireless might play another role altogether, such as with high-gain line-of-sight antennas providing last-mile connectivity.

However, even with these distinctions, the experience from one Canadian ISP, Wireless Nomad, helps to illuminate some of the considerations which may be relevant to other deployments hoping to use wireless. These included cost and technological considerations which may be key factors for a small business. Whereas a larger organization might be able to able to mitigate such concerns relatively easily, often small businesses are restricted by access to fewer resources and potential solutions (e.g. financial, geographical, labour). Future work in this area might better explore more general wireless Internet solutions as well as focus on more specific ways that Internet might assist small businesses in getting established and growing out.

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